Chem 101 Activity on Dimensional Analysis

Exercises

KEEP IN MIND WHEN PRACTICING:

- Do these exercises on a separate piece of paper, showing all of your work. ***This will NOT be graded*** but showing your work is good practice.
- You ***need to know*** how to use the metric prefix table.
- You ***do not*** need to know English to metric conversions by memory. They will be provided on exams.

I. **Jabberwocky**

This exercise is to reinforce the concept that problems are set up based on UNITS. Nonsense words taken from the poem *Jabberwocky* (from Lewis Carroll's *Through the Looking Glass*)

There are 20 tumtum trees in the tulgey wood. (20 tt = 1 tw)

In each tulgey wood is one frumious Bandersnatch. (1 tw = 1 fB)

There are 5 slithy toves in 2 borogoves. (5 st = 2 bg)

There are 2 mome raths per Jabberwock. (2 mr = 1 Jw)

There are 2 Jubjub birds in 200 tumtum trees. (2 Jb = 200 tt)

There are 200 mome raths in each borogove. (200 mr = 1 bg)

There are 5 Jubjub birds per slithy tove. (5Jb = 1 st)

The question is: If there are 5 frumious Bandersnatches, how many Jabberwocks are there? You should use a dimensional analysis setup to show your work! *HINT: What information above is a conversion factor and what information is not?*

$$?\ \text{Jw} = 5\ \text{fB} \times \frac{1\ \text{tw}}{1\ \text{fB}} \times \frac{20\ \text{tt}}{1\ \text{tw}} \times \frac{2\ \text{Jb}}{200\ \text{tt}} \times \frac{1\ \text{st}}{5\ \text{Jb}} \times \frac{2\ \text{bg}}{5\ \text{st}} \times \frac{200\ \text{mr}}{1\ \text{bg}} \times \frac{1\ \text{Jw}}{2\ \text{mr}} = \boxed{8\ \text{Jw}}$$

II. If you have done the previous problem correctly, you have just done a "multi-step conversion" problem (a problem that involves more than one conversion factor). Here is some practice with multi-step conversions. If needed, use conversion factors from the previous worksheet.

1. Calculate the cost of gasoline for a 420 mile trip if your car averages 20 miles/gal of gas, and the gas costs $0.95/gallon. *(your gas mileage is dependent on a lot of factors, so think about how impossible it is to know to the penny how much you will end up spending!)*

$$?\ \$ = 420\ \text{mi} \times \frac{1\ \text{gal}}{20\ \text{mi}} \times \frac{\$0.95}{1\ \text{gal}} = \$19.95 = \boxed{\$20.}$$

2. Harold's car has a fuel efficiency of 35 miles per gallon. Kumar's car has a fuel efficiency of 12 kilometers per liter. Who gets better gas mileage, Harold or Kumar?

$$\text{Harold: } \frac{?\ \text{km}}{1\ \text{L}} = \frac{35\ \text{mi}}{1\ \text{gal}} \times \frac{1.6093\ \text{km}}{1\ \text{mi}} \times \frac{1\ \text{gal}}{4\ \text{qts}} \times \frac{1.057\ \text{qt}}{1\ \text{L}} = 14.884\ \text{km/L} = \boxed{15\ \text{km/L}}$$

or

$$\text{Kumar: } \frac{?\ \text{mi}}{1\ \text{gal}} = \frac{12\ \text{km}}{1\ \text{L}} \times \frac{1\ \text{mi}}{1.6093\ \text{km}} \times \frac{1\ \text{L}}{1.057\ \text{qt}} \times \frac{4\ \text{qts}}{1\ \text{gal}} = 28.22\ \text{mi/gal} = \boxed{28\ \text{mi/gal}}$$

Harold gets better "mileage"

3. A unit of length called the "furlong" is used in horse racing. The units of length called the "chain" and the "link" are used in surveying. There are 8 furlongs in 1 mile (mi), 10 chains in

1 furlong, and 100 links in 1 chain. To three significant figures, what is the length of 1 link in inches?

$$? \text{ in} = 1 \text{ link} \times \frac{1 \text{ chain}}{100 \text{ link}} \times \frac{1 \text{ furlong}}{10 \text{ chains}} \times \frac{1 \text{ mi}}{8 \text{ furlongs}} \times \frac{1760 \text{ yd}}{1 \text{ mi}} \times \frac{3 \text{ ft}}{1 \text{ yd}} \times \frac{12 \text{ in}}{1 \text{ ft}} = \boxed{7.92 \text{ in}}$$